Bell Work
23.Oct.2017

Please log f onto a computer and make your way to the class:

Webpage → Labs → "Intro to Energy and Light RXTE"

While you are logging on try to explain what "light" is.

What are use of light other than "seeing?"

EQ:

Is radiation bad for you or just misunderstood, why?

Objective: You will be able to identify various forms of light energy and the symbols for frequency, wavelength, speed of light, planks constant, and energy in a mathematical expression.

RXTE

Do ***all*** of the reading before answering questions.

Complete on a separate sheet of paper appropriately titled; “RXTE”.

Home work
23.Oct

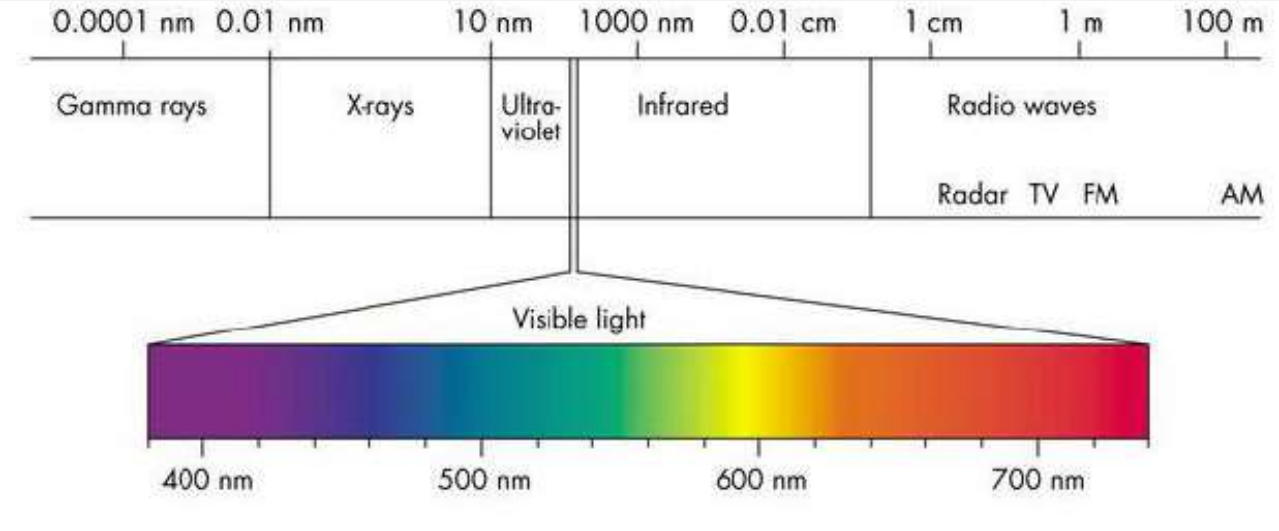
- Cereal/ cracker box
- Old CD or DVD (they will be broken into pieces)
- Continue with Science Fair

Bell Work
24-Oct-2017

A: We have trouble seeing light at 325nm, what is the wave length in meters (use your green sheets)?

B: What region is the light in?

C. If the speed of light, c, is $3x10^8 ms^{-1}$, what is the frequency, ν, of the light (λ =325nm)?

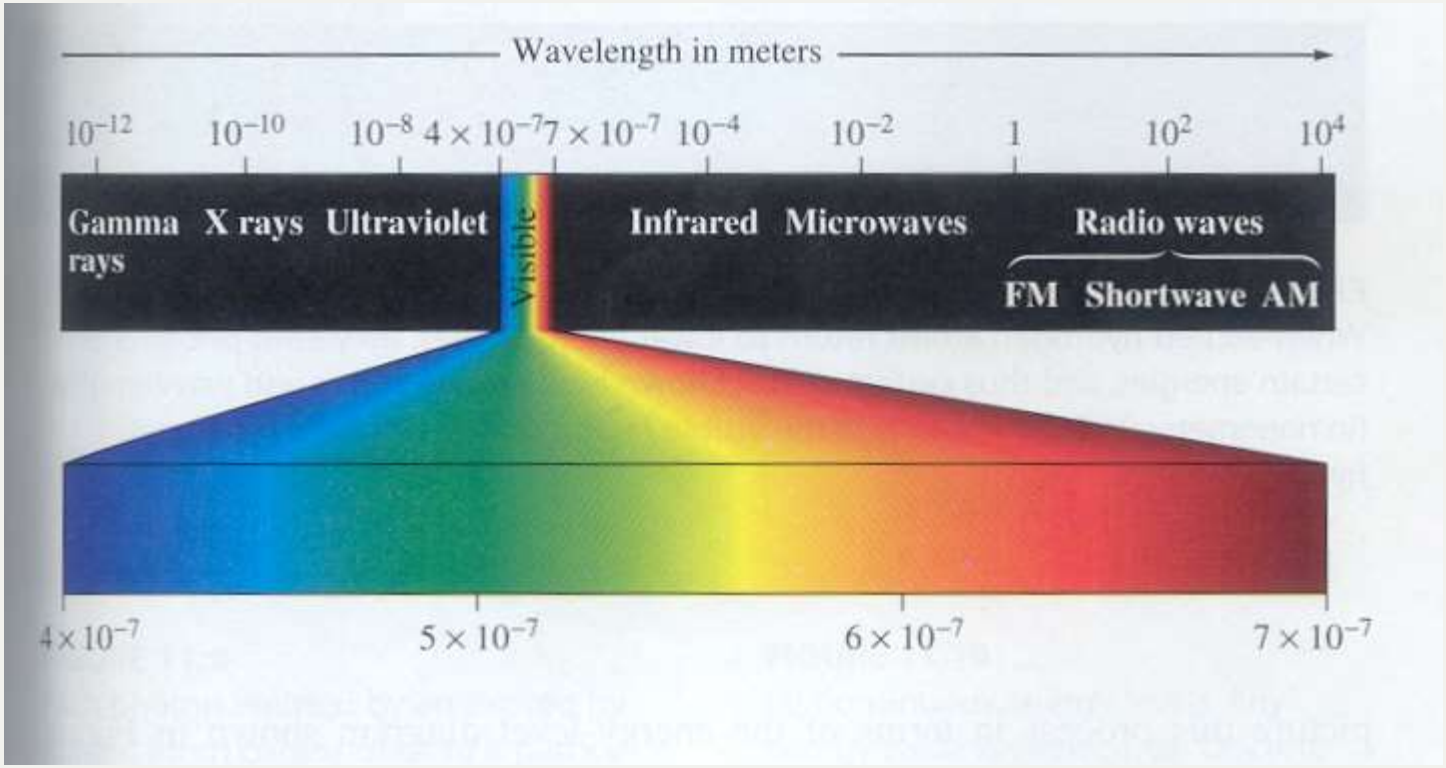


Objective

You will construct and then understand how to use a CD box/ paper SPECTROscope and decode the line spectrum it reveals.

EQ:
Is radiation bad for you or just misunderstood, why?

The Light Spectrum



Warm up, get a text book and open to page 96

1. Which electromagnetic wave type has the largest wavelength?
2. Which electromagnetic wave type has the smallest wavelength?
3. Which electromagnetic wave type has frequencies lower than the red of visible light?
4. Which electromagnetic wave type has frequencies higher than the violet of visible light?

Turn In, 24-Oct-17

Turn in CD Box Spectroscope Question (HW)

Bell Work
25-Oct-2017

What is the relationship between wavelength and frequency or energy?

“ As wavelength increases frequency and energy _____”

What is the energy of a photon with a frequency of 2.4GHz?

(Hz = s^{-1}, E = h λ, c = λν)

Objective:

Identify the various bands, (visible colors) present in various light sources in the lab.

EQ:

Is radiation bad for you or just misunderstood, why?

LIGHT: What Is It?

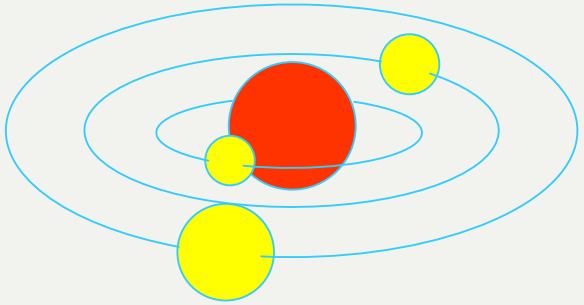
Light Energy

Atoms

- As atoms absorb energy, electrons jump out to a higher energy level.
- Electrons release light when falling down to the lower energy level.
- We will talk more abut this is a few weeks

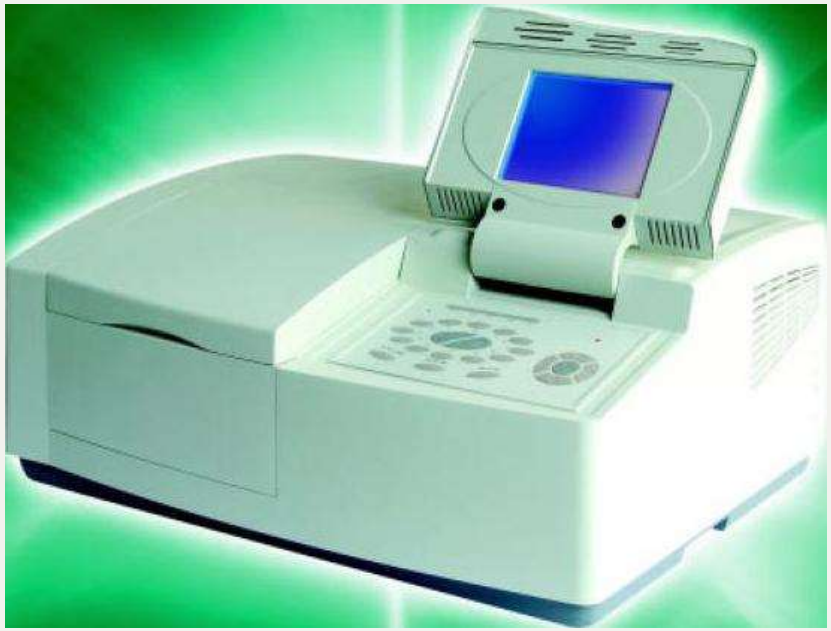
Photons - bundles/packets of energy released when the electrons fall.

Light: Stream of Photons



The Spectrophotometer

Spectrophotometer: An instrument used to measure the intensity of electromagnetic radiation at different wavelengths.



The Spectrograph

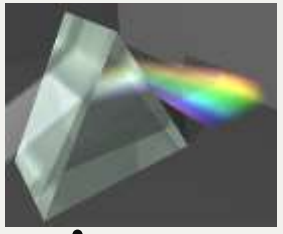
What is light (white) light composed of?

Well … white light is not actually white – it consists of many different colors.

Light is actually a *spectrum* – it is studied by a device called a *spectrometer*

How to separate light

There are different ways to split white light into its different colors.



One way is to use a prism

We're going to use *diffraction grating*, which consists of a large number of tiny grooves, placed parallel to each other on a surface.

You actually have high-quality diffraction gratings at home:

Compact discs (CDs).

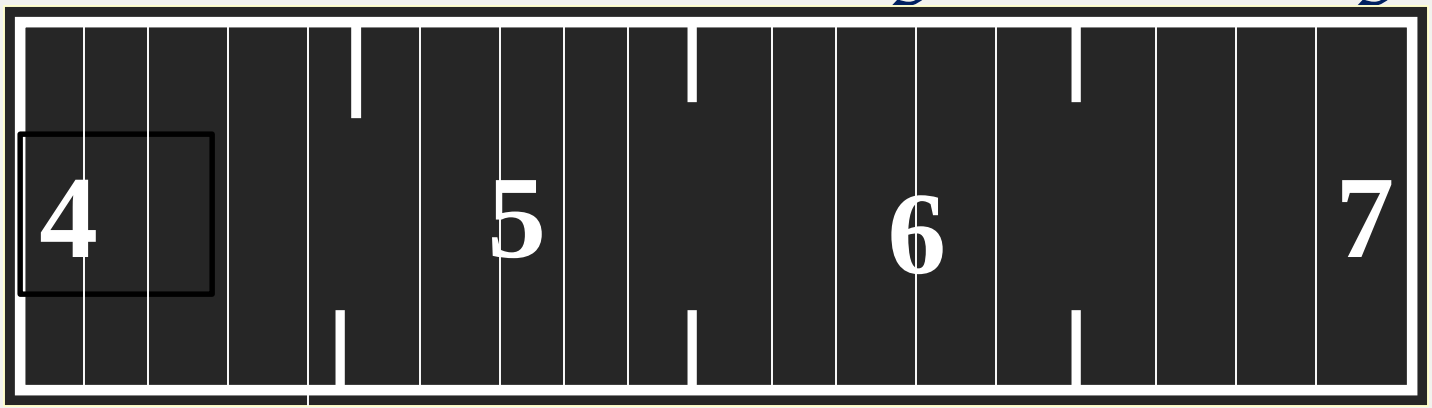
CD Box Spectroscope

In the lab, safe handling of the scissors

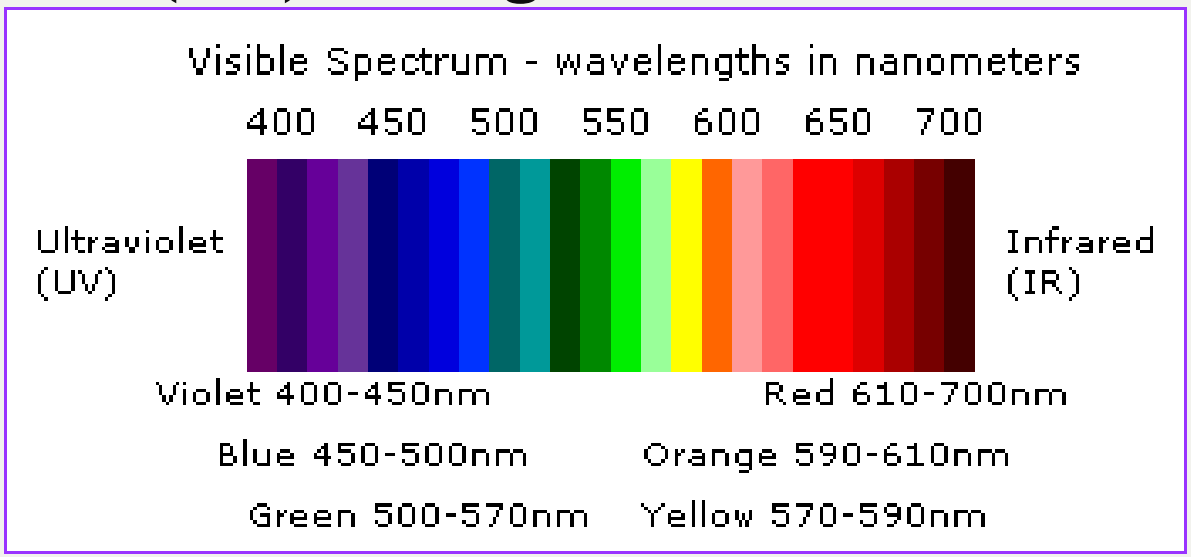
How To use the Spectometer

On the left side is a slit where you aim toward the light

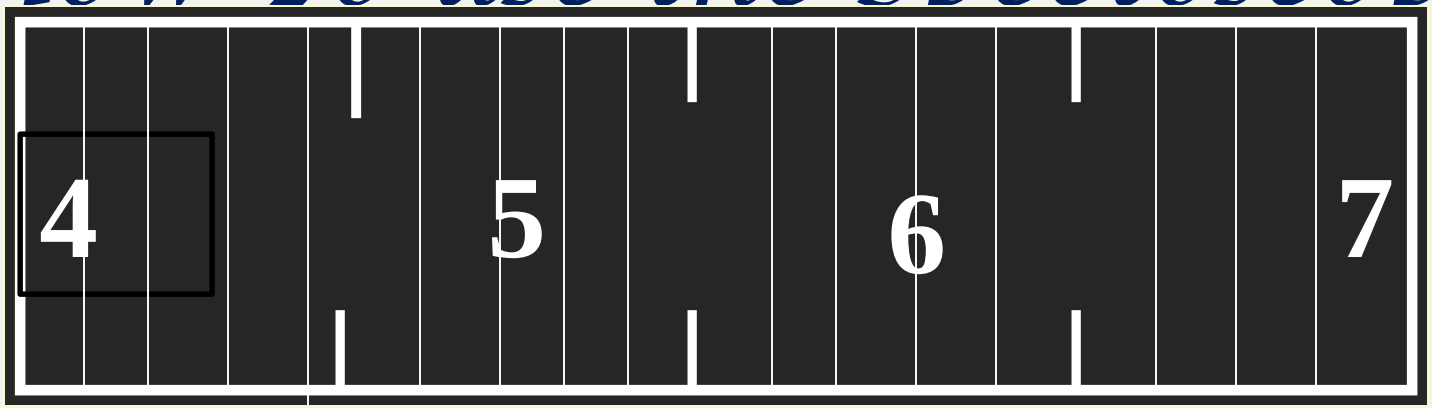
How To use the Spectoscope



On the right hand side is the grating measured in nanometer (nm). Going from 400-700nm.



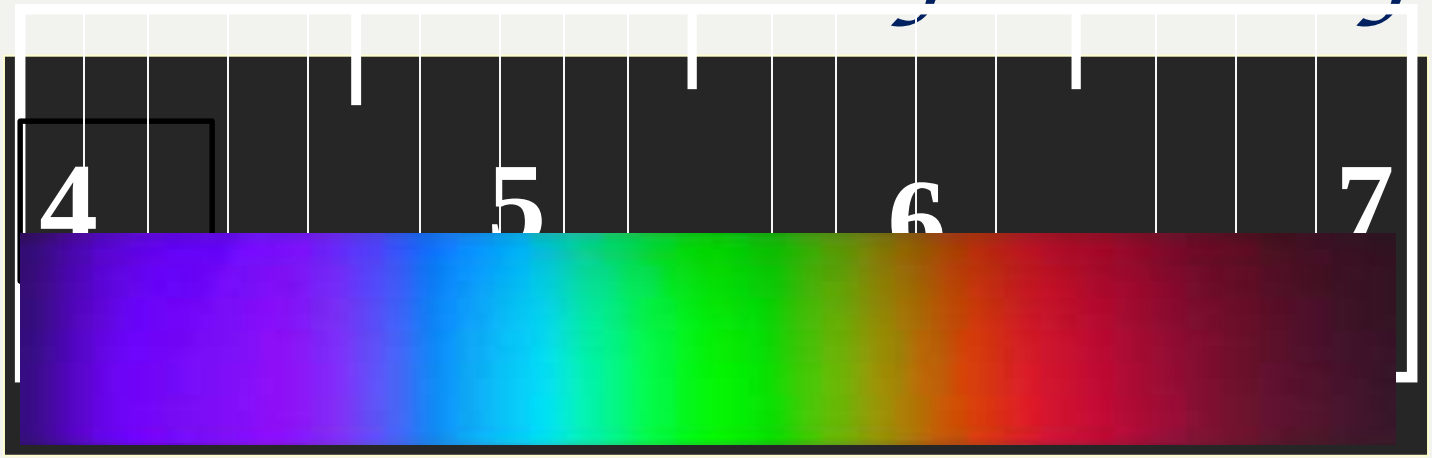
How To use the Spectoscope



The grating is where the colored line spectrum will show up.

Now aim the slit on the left at the light bulb….

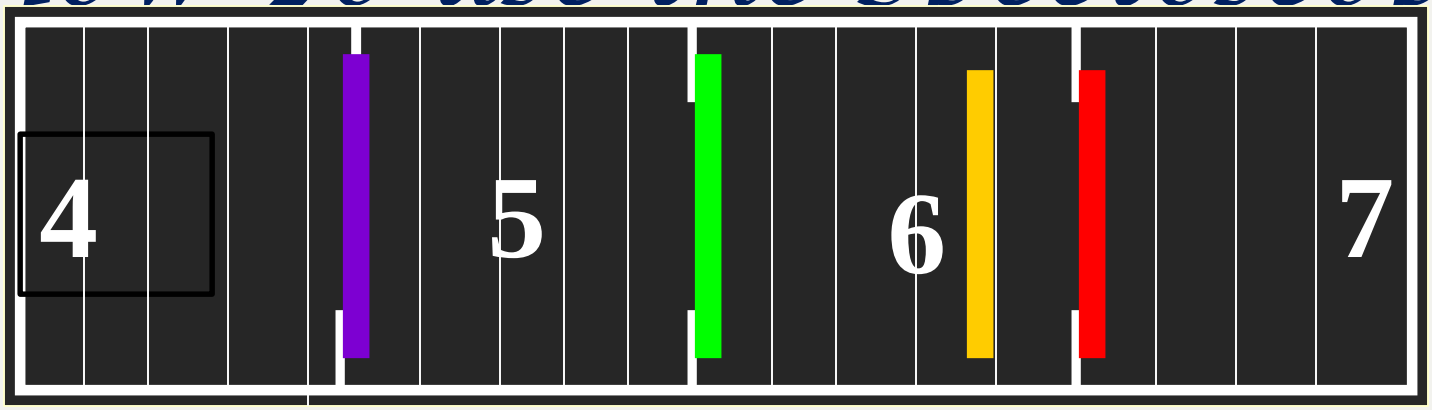
How To use the Spectoscope



What do you see?

What is the value of the “green” region?

How To use the Spectoscope



Now look at the florescent bulbs in the ceiling… draw what you see…

How To use the Spectoscope

The ***emission lines*** from the florescent bulb are produced by low-density mercury (Hg) vapor in the tube. The mercury also produces ultraviolet (UV) light, which is turned into a continuous spectrum of visible light by a thin layer of phosphor on the inside of the tube

Spectroscope Lab

Caution!!! Do Not Touch the power source OR tubes at any time.

Color what you see using the colored pencils.

How are they formed

Some of the spectra seen with the spectroscope have a continuous background.

Others consist of sharp lines on a continuous background, sharp lines without background, or even dark lines on a continuous background.

Why all this diversity?

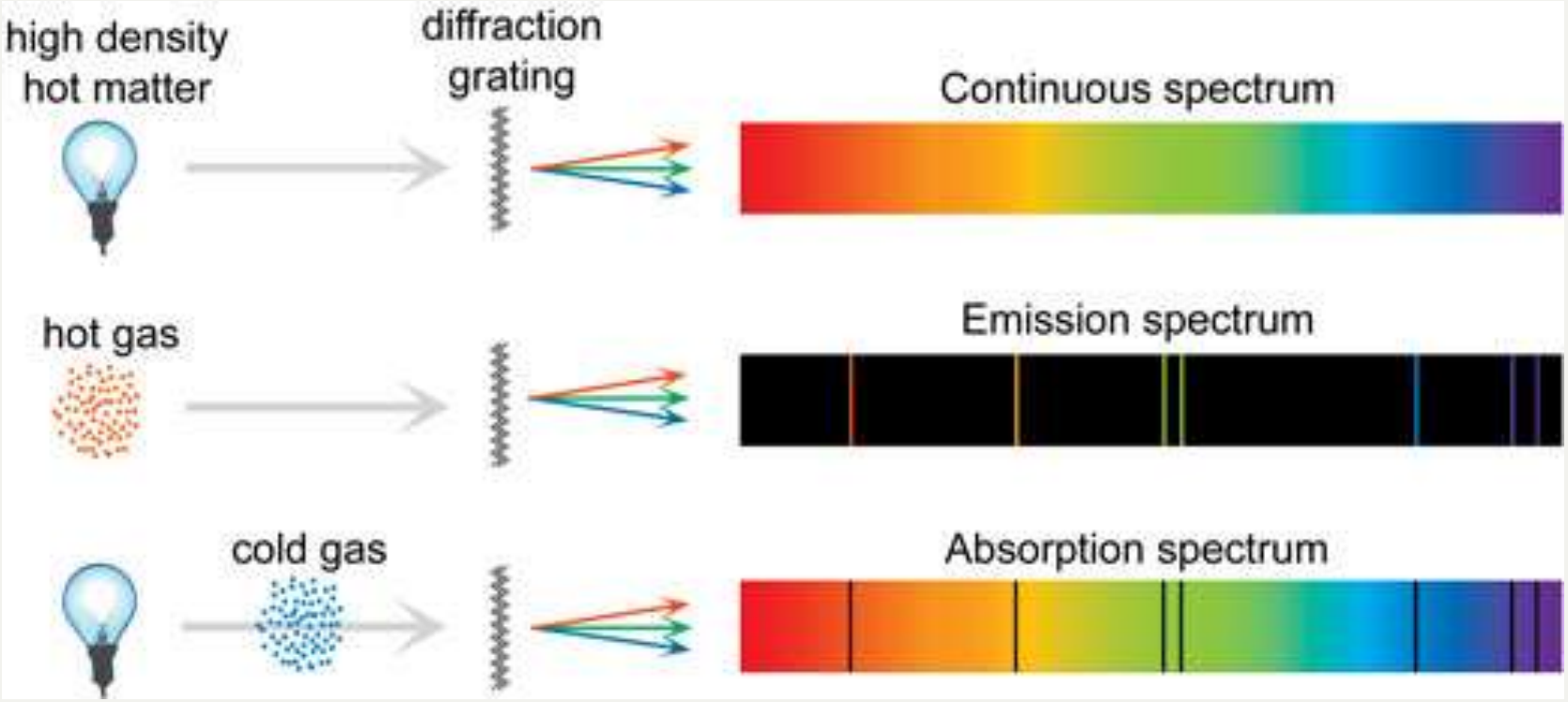
How are spectra formed?

Why is it happening

The atoms. An individual atom can find itself in an excited energy state, depending on whether its e^- occupy their usual orbits or have been excited to higher orbits and are emitting photons

The energy of the emitted photon determines its color.

Why is it happening



Bell Work,
27-Oct-2017

What are the various types of light (aka electromagnetic radiation), list spectrum in order of increasing frequency.

Bell Work
30-Oct-2017

What is radiation? Be specific in your explanation.

How many neutrons does ^{38}Ar have?

If $E = h\nu$, what is the energy (E) of a beam of light at $10^{8} s^{-1}$, knowing that $h = 6.626 \times 10^{-34} J \cdot s$?

Objective:

Review properties of “light”, (EMS and Radiation).

Practice and understand various calculations for E, λ, ν, and c.

NATURE OF WAVES

- **Waves *(Def.)* – A wave is a disturbance that transfers energy.**
- **Medium – Substance or region through which a wave is transmitted.**
- **Speed of Waves – Depends on the properties of the medium.**
- **Vacuum - A space empty of matter**

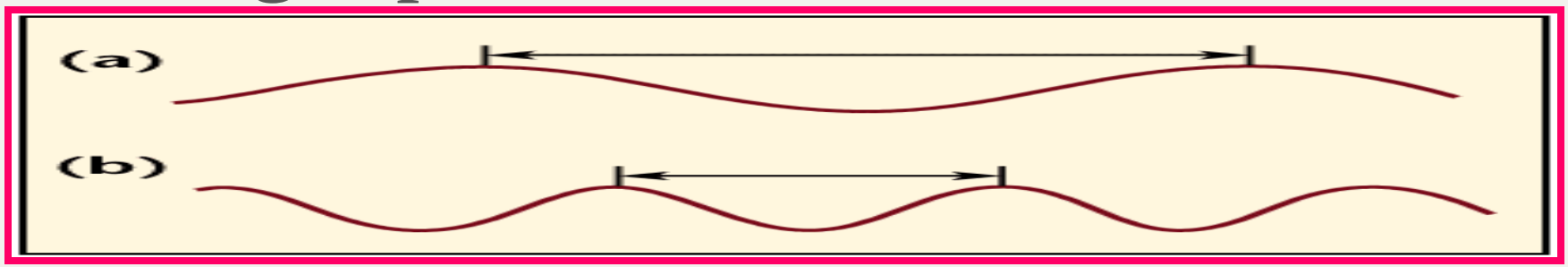
LIGHT: Particles or Waves?

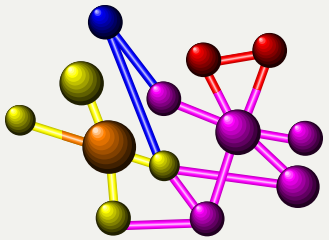
Wave Model of Light

- Explains most properties of light

Particle Theory of Light

- Photoelectric Effect – Photons of light produce free electrons





Electromagnetic Waves
Speed of light

Speed in Vacuum

- 3.00×10^8 m/s = Speed of light
- c = speed of light
- Speed only applicable in a vacuum. We will assume all conditions in this class to be a vacuum

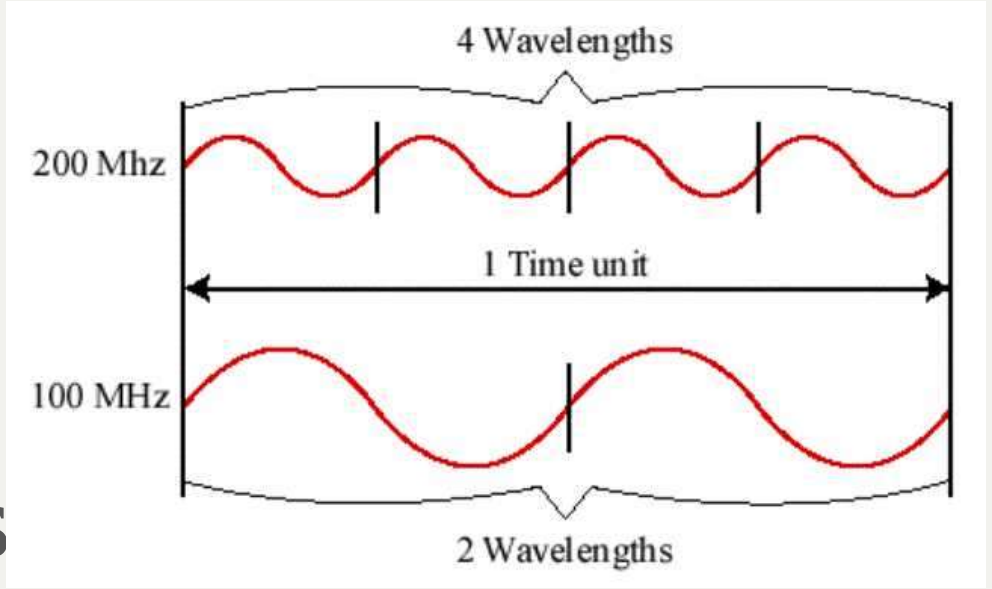
Electromagnetic Frequency

Frequency

- Number of wave peaks in a given period of time

- **υ = frequency (Greek letter nu)**
- Units for frequency are Hertz (Hz) cycles per second (s^{-1})

Electromagnetic Wavelength



Wavelength

- Distance between peeks

- λ = wavelength (Greek letter lambda)
- Units for wavelength is meter (**m**)

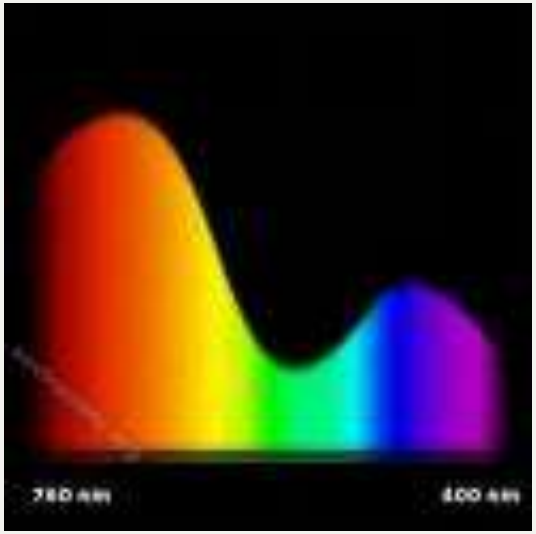
1m = 10^9 nanometer (nm)

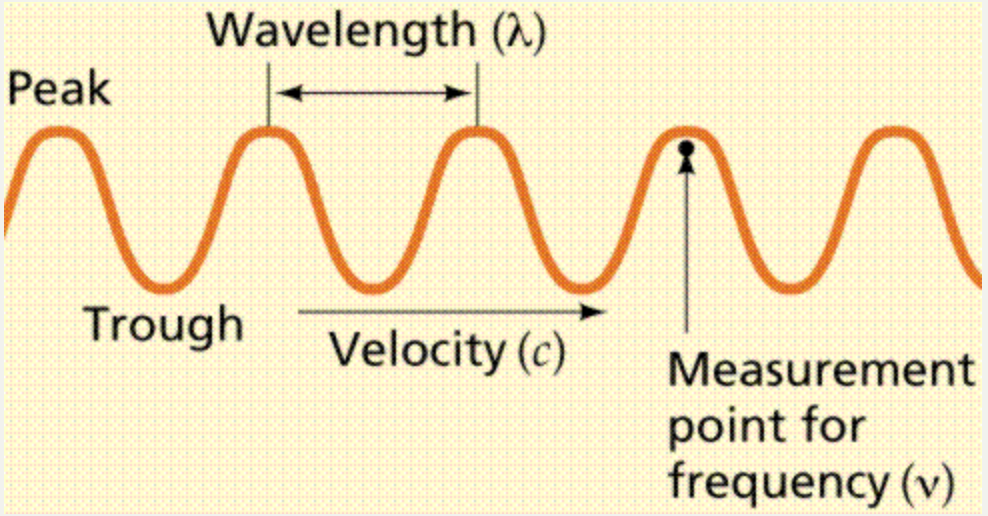
Formula For a Wave

The wave formula

$$c = \upsilon \bullet \lambda$$

Speed of light = frequency x wavelength





Practice Makes Perfect

What is the speed of a photon of light in nm/s if it has a wavelength of 480nm and a frequency of 7.50 x 10^{11} Hz?

Wavelength λ= 480nm

speed = λ υ

Frequency υ = 7.50 x 10^{11} Hz (1/s)

speed = 480nm x 7.50 x 10^{11} s^{-1}

= _____

Your Turn

Calculate the frequency of red light that has a wavelength of 700.0 nm if the speed of light is 3.00×10^{8} m/s

HW 30-Oct-17
Finish !

"Frequency and Wavelength Worksheet" all work on numbered separate sheet of paper

Memorize the seven (7) parts/ regions on the electro-magnetic spectrum (EMS) .
You should know these in order of increasing wavelength (λ) and frequency (ν).

Science Fair, duh Mr. Golden, everyday.

Closure

What were three (3) difficulties you had in the lab?

How could/ did you over come them?

Bell Work,
31-Oct-2017

What are the various types of light (aka electromagnetic radiation), list spectrum in order of *increasing* frequency.

No Notes, all from memory!

Given that $c = \lambda\nu$, what is the frequency of a 700nm emission of light? Knowing that $c = 3.0E^{8} m \cdot s^{-}$?

EQ: When speaking ill of an individual to others what does one risk?

Objective

You will examine the emission spectrum of various metal salts and sources of visible light.

Turn in!

“Frequency and Wavelength Worksheet”

Home Work 31-Oct-17, due 2Nov17

“Electromagnetic Radiation Worksheet”

Science Fair, duh Mr. Golden, everyday.

Flame Test lab

Read through literature on pre-lab, you are responsible for the content!

Pre-lab Questions:

1. Look at energy diagram in text book, Pg. 96.
2. Recall from yesterday
3. We will skip the HCl cleaning ~~but will still clean with DI H_2O~~
4. Think about the colors?
5. Think about our lesson yesterday and spectroscope?
6. Look at all of the compounds.

When you finish make a data table for all of your collection please add a row for $CuSO_4$ and $NiCl_2$.

Flame Test lab

You will be rotating through each of the seven (7) stations:

a. Hold the Pt wire in the flame and record your results in the data table. Do not let it burn.

b. Repeat the flame test while attempting to view the flame with the spectroscope (2x so each partner may see) and record the colors of any bright lines you see.

c. Tidy the table then move on to the next lab station (3-5min max per-station).